PATENT COOPERATION TREATY

TRANSLATION

From the
INTERNATIONAL SEARCHING AUTHORITY

To:

PCT

WRITTEN OPINION OF THE
INTERNATIONAL SEARCHING AUTHORITY

(PCT Rule 43*bis*.1)

Date of mailing *(day/month/year)*	See Form PCT/ISA/210 (sheet 2)
Applicant's or agent's file reference: 0060-PCT	FOR FURTHER ACTION: See paragraph 2 below

International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/EP2005/051451	30.03.2005	08.04.2004

International Patent Classification (IPC) or both national classification and IPC
G03F7/20, H01J37/317, G11 B11/00

Applicant
GIESECKE & DEVRIENT GMBH

1. This opinion contains indications relating to the following items:

☒	Box No. I	Basis of the opinion
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Rule 43*bis*.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☒	Box No. VIII	Certain observations on the international application

2. FURTHER ACTION

If a demand for international preliminary examination is made, this opinion will be considered to be a written opinion of the International Preliminary Examining Authority ("IPEA") except that this does not apply where the applicant chooses an Authority other than this one to be the IPEA and the chosen IPEA has notified the International Bureau under Rule 66.1*bis*(b) that written opinions of this International Searching Authority will not be so considered.

If this opinion is, as provided above, considered to be a written opinion of the IPEA, the applicant is invited to submit to the IPEA a written reply together, where appropriate, with amendments, before the expiration of 3 months from the date of mailing of Form PCT/ISA/220 or before the expiration of 22 months from the priority date, whichever expires later.

For further options, see Form PCT/ISA/220.

3. For further details, see notes to Form PCT/ISA/220.

Name and mailing address of the ISA/EP	Authorized officer
Facsimile No.	Telephone No.

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Box No. I Basis of this opinion

1. With regard to the language, this opinion has been established on the basis of the international application in the language in which it was filed, unless otherwise indicated under this item.

☐ This opinion has been established on the basis of a translation from the original language into the following language _____, which is the language of a translation furnished for the purposes of international search (under Rule 12.3 and 23.1(b)).

2. With regard to any nucleotide and/or amino acid sequence disclosed in the international application and necessary to the claimed invention, this opinion has been established on the basis of:

a. type of material

☐ a sequence listing

☐ table(s) related to the sequence listing

b. format of material

☐ in written format

☐ in computer readable form

c. time of filing/furnishing

☐ contained in the international application as filed.

☐ filed together with the international application in computer readable form.

☐ furnished subsequently to this Authority for the purposes of search.

3. ☐ In addition, in the case that more than one version or copy of a sequence listing and/or table(s) relating thereto has been filed or furnished, the required statements that the information in the subsequent or additional copies is identical to that in the application as filed or does not go beyond the application as filed, as appropriate, were furnished.

4. Additional comments:

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Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims	25-30	YES
	Claims	1-24	NO
Inventive step (IS)	Claims		YES
	Claims	1-30	NO
Industrial applicability (IA)	Claims	1-30	YES
	Claims		NO

2. Citations and explanations:

1. The present application does not meet the requirements of PCT Article 33(1) because the subject matter of the independent claim is not novel within the meaning of PCT Article 33(2).

Document D1 discloses (the references between parentheses relate to said document):
An electron beam device (LION LV1) for producing resist profiles in both positive and negative resists (page 72, final lines) by means of writing techniques which use both a variable dose and variable energy (section 4) and variable beam geometry (section 5.2) in order to produce the desired non-vertical resist profiles. Technologies that are generally used for CD production are also mentioned in this connection. Resist thicknesses of 200 and 350 nm are likewise explicitly mentioned. D2, which was published at the same time by the same author, describes some concrete examples in detail (section 3.4).

The device used in D1 therefore corresponds to that of independent claim 1 and also explicitly anticipates the subject matter of dependent claims 2-12.

The corresponding method claims, claims 13-24, are likewise anticipated by D1, and neither novelty nor inventive step can be recognized for said claims. D5 can also be considered as prejudicial to the novelty of the claims mentioned in the search report.

It is pointed out in this connection that a number of parameters designated as relevant to the claimed invention relate to normal properties of an electron beam. It is pointed out as early as in D3 and D4 (1975) that high-resolution resist lines produced, in particular, by an individual writing step cannot have perpendicular edges. The scattering of the beams is simulated there and the corresponding structures are also actually produced under specific conditions. This effect has also already been utilized for lift-off structures, with the production of overhanging sidewalls in a positive resist, corresponding to the profile of the scattering bulb (D5). The fact that the properties of the resist (sensitivity, scattering behaviour and contrast) greatly influence the profile is likewise known to a person skilled in the art (D3, D5, D6).

2. The subject matter of claims 25-30 does not involve an inventive step within the meaning of PCT Article 33(3), and so the requirements of PCT Article 33(1) are not met.

It can be gleaned from document D1 that practically any desired resist structure can be produced by means of the method described therein. In view of the fact that the structures desired for the various applications, that is

Box No. V Reasoned statement under Rule 43bis.1(a)(i) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

to say sinusoidal, sawtooth, trapezoidal, etc., are also known and familiar to a person skilled in the art in the specific areas of application, the use of the method known from D1 is obvious as an alternative. Therefore, an inventive step cannot be recognized for the subject matter of claims 25-30. As soon as a person skilled in the art wishes to produce high-resolution structures, the use of electron beam lithography is obvious.

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Box No. VIII Certain observations on the international application

The following observations on the clarity of the claims, description, and drawings or on the question whether the claims are fully supported by the description, are made:

The application does not meet the requirements of PCT Article 6 because claim 1 is not clear.

Claim 1, which defines a device, is distinguished by the fact that a non-orthogonal profile can be produced in a resist. However, this can only be regarded as a desirable property, and does not preclude the "apparatus" or the device from being able equally well to produce an orthogonal profile. Therefore, the device as such is inadequately defined.

Neither the claims nor the description clearly reveals whether or not the present method, or device supports progressive stepped exposure. Such stepped intensity patterns are known from the prior art. Owing to the known scattering effects the structures obtained do not correspond, however, to the ideal stepped structure, inter alia owing to the scattering effect and the contrast of the resist, with the result that oblique edges are produced. The indication, in particular that the probe size is smaller than the feature size, in this regard also see claims 11 and 22, suggest a method as per D7. A trapezoidal resist structure is produced in said method.

Supplemental Box

In case the space in any of the preceding boxes is not sufficient.

Continuation of:

Reference is made to the following documents:

D1: Kley *et al.*; SPIE vol.2640, pages 71-80, XP009031977

D2: Brünger, Kley *et al.*; Microelec. Eng, 27, pages 135-138, (1995) XP004025049

D3: Heidenreich *et al.*; J.Vac.Sci.B, 12(6), pages 1284-1288 (1975)

D4: Lin, L.H.; J.Vac.Sci.B, 12(6), pages 1289-1293 (1975)

D5: Jagdhold *et al.*; SPIE vol.3049, pages 757-764

D6: Ham *et al.*; Jpn.Jnl.Phys, 37, pages 6761-6766, (1998) XP000880252

D7: Wittig *et al.*; Microelc.Eng., 57-58, pages 321-326 (2001) XP004302280